Synchronization hypothesis in the Winfree model

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Résumé

In 1967 Arthur Winfree proposed a model describing the synchro-
nization of a population of organisms or oscillators that interact simul-
taneously as , the neurons, the circadian pacemaker cells, and other bio-
logical populations and describing the circadian rhythm . The Winfree
model is one of the coupled mean-field systems with an independent-
time perturbation. We present a hypothesis for which we can find such
synchronization in the Winfree model. We show analytically the exis-
tence of synchronized oscillators when this hypothesis is satisfied and
when the perturbation is small. In addition we show the existence of
periodic oscillators with the same rotation number. We give a numer-
ical counter-example which shows that this hypothesis is necessary for
the existence of synchronization also without perturbation of model.

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